

Harmful Algal Blooms in Sequim Bay

Current state of our research and understanding

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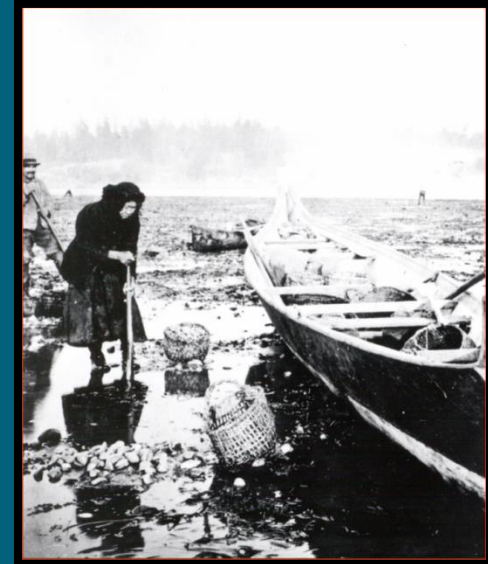
My talk has three parts:

1. History of HABs in Sequim Bay
2. Jamestown S'Klallam Tribe's 2008-2014 research
3. Where do we go from here and how does this fit in to a larger picture of Puget Sound

Jamestown S'Klallam Tribe

Background

- Tribe retained fishing and shellfish harvest rights in the 1855 Treaty of Point No Point
- Shellfish remain important subsistence, ceremonial and economic resource



General Review of Harmful Algal Blooms (HABs) in Sequim Bay

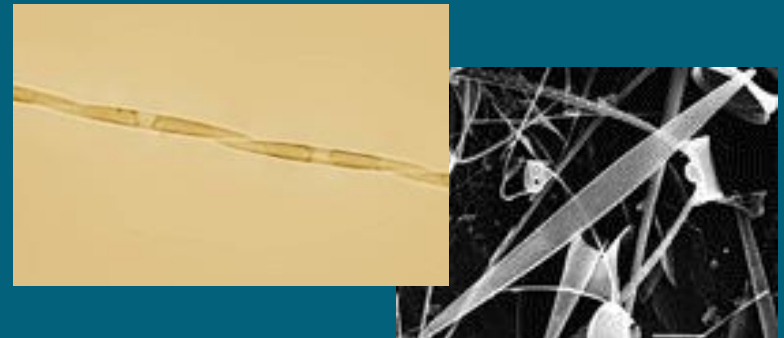
- Paralytic Shellfish Poisoning

- *Alexandrium catenella*-dinoflagellate
- Reoccurring blooms in SB since 1957
- Saxitoxins: high doses lead to paralysis



- Amnesiac Shellfish Poisoning

- *Pseudonitzschia* spp. of diatoms
- Event in Sequim Bay 2005
- Domoic acid- loss of short term memory



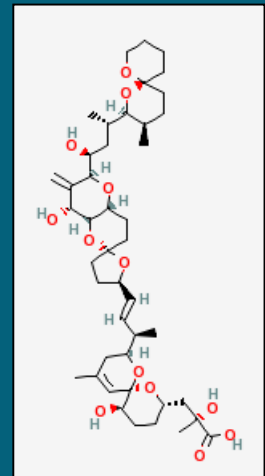
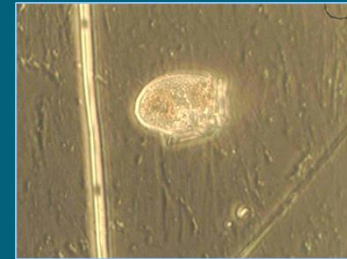
Monitoring efforts 2008-2011

- Soundtoxins 2008
- Intensive study of PSP and ASP in 2009-2010
 - No major blooms of PSP or ASP in those years
- 2011 Marine nutrient study in Dungeness and Sequim Bay (with an eye toward eelgrass health and macroalgae)
- AND THEN DSP!



Response to a new threat to health: Diarrhetic Shellfish Poisoning (DSP)

- Diarrhetic Shellfish Toxins (DTXs)
- Causes severe gastrointestinal distress
- 1st confirmed US cases at Sequim Bay S.P. in 2011
- Had to put aside (but not forget) our larger question about nutrients.



What did we need to know (fast)

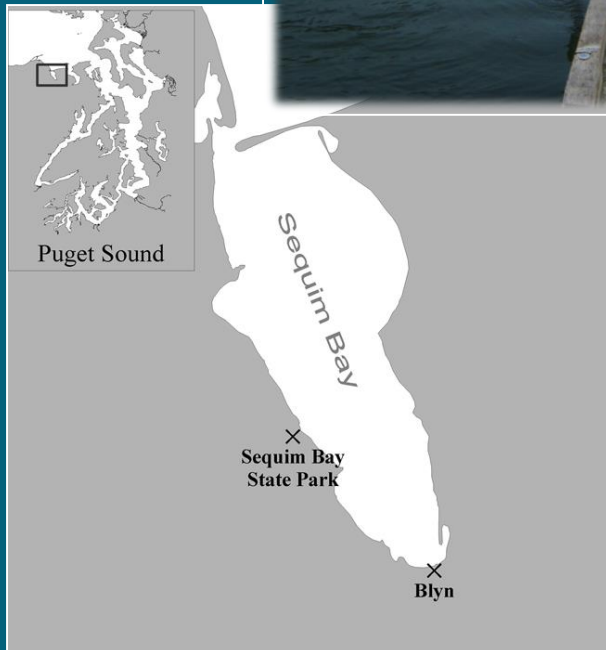


- Can *Dinophysis* abundance give a warning of toxic events? Are some species more toxic than others?
 - Work with NOAA and Soundtoxin partnership
- How do we know if shellfish are toxic? If so are different species more affected?
 - We evaluated Jellett rapid test strips
 - NOAA and WDOH LC-MS

2012-2014 DSP Studies

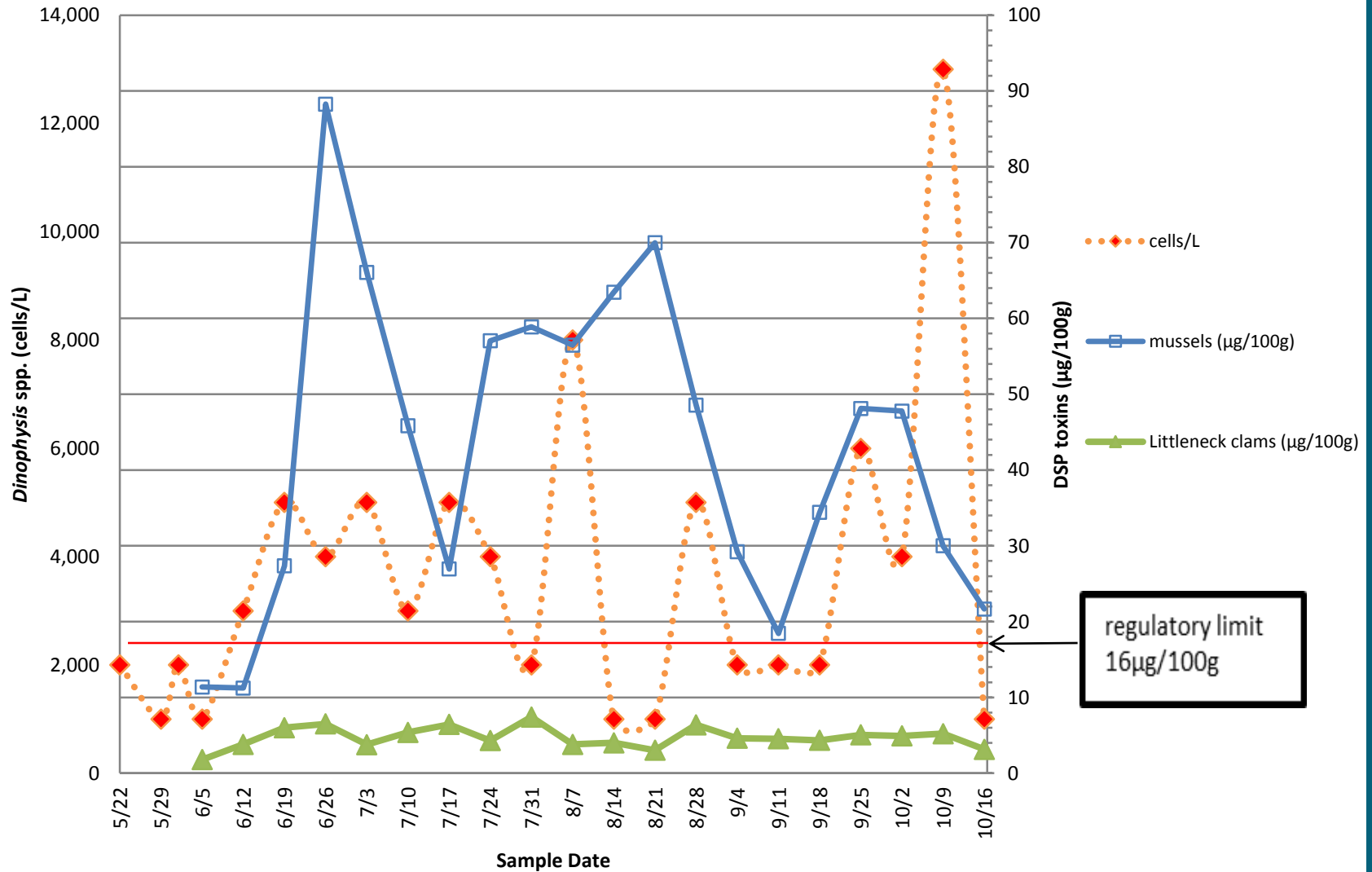


- Sampled weekly May-Oct. at two sites for:
 - Phytoplankton
 - Shellfish
 - Temperature, salinity, chlorophyll, pH
 - Evaluated shellfish DSP rapid-test kits in 2012
 - Nutrients in 2013 and 2014



Sequim Bay State Park 2012

Dinophysis vs shellfish toxicity



What did we learn about DSP?

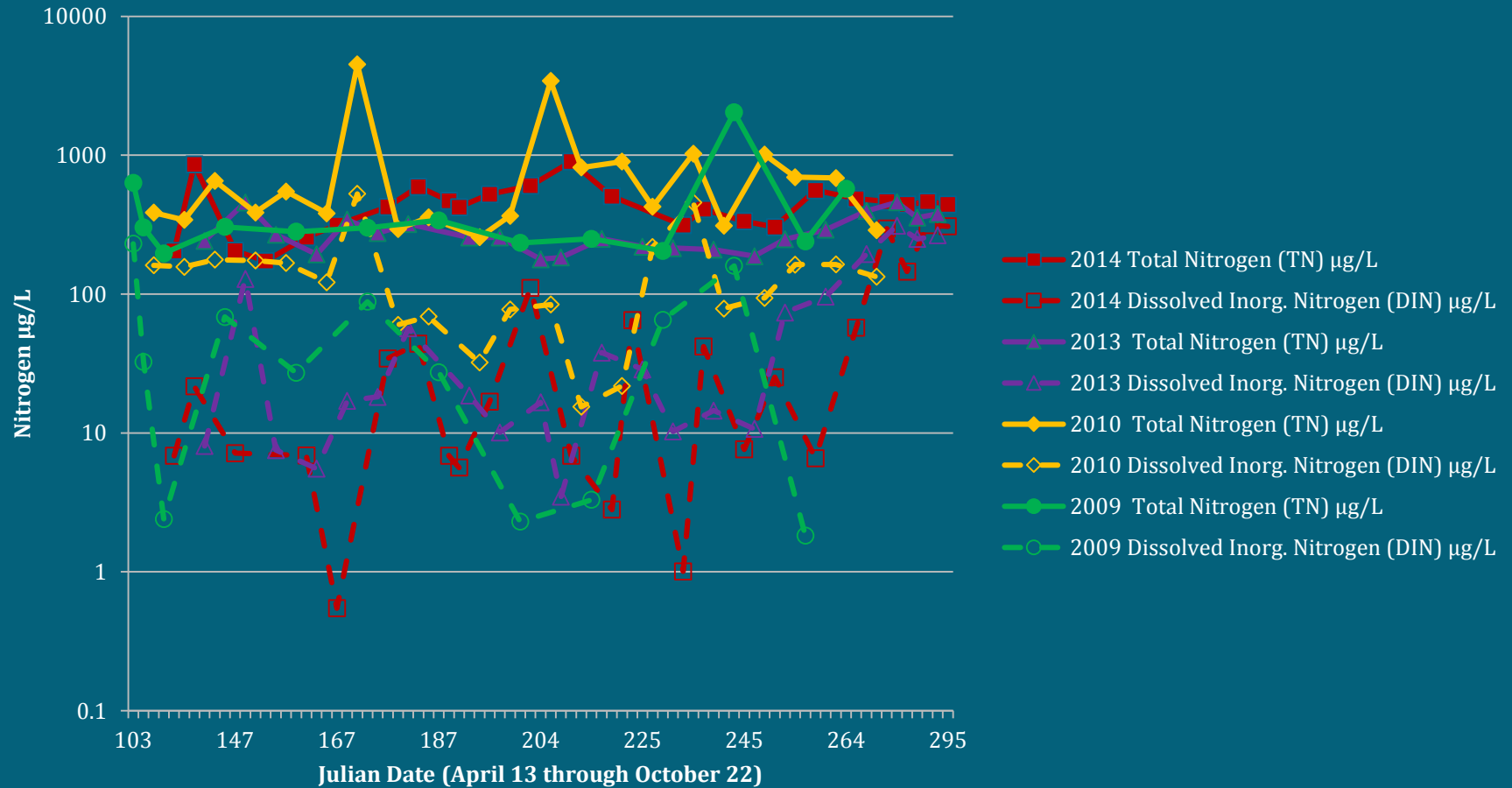
- Dinophysis cell density proceed increases in DSTs in shellfish
- Dominant toxin is DTX1
- *Dinophysis acuminata* was the dominant species of *Dinophysis* during toxic events
- Different species of shellfish uptake toxin in different amounts
- The rapid test strips were not accurate enough for management decisions

Other HABs in Sequim Bay

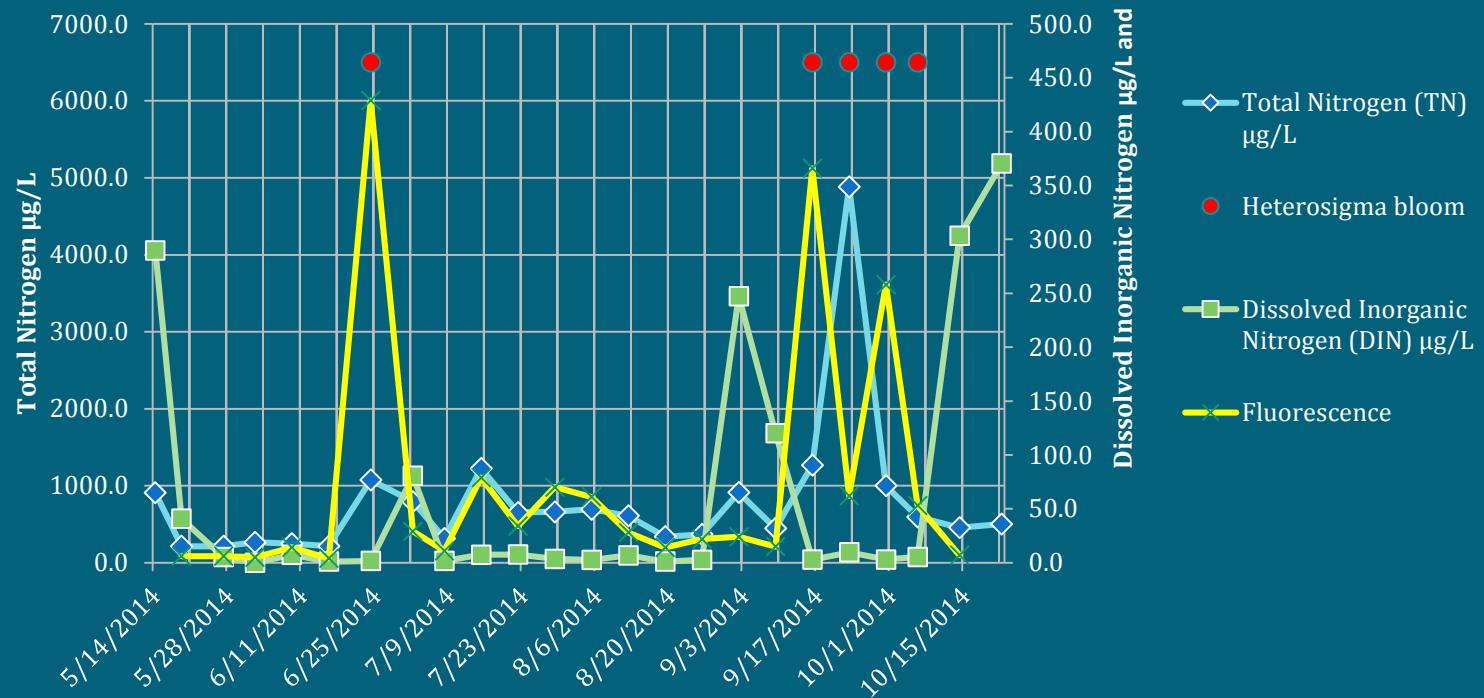
- 2012 bad year bad year for PSP
 - Peaking at 1595 μ g/ 100g
 - Also high in *December* 2012
- Above the limit also October 2013
- ASP: Cells present but no toxicity in shellfish
- *Heterosigma* blooms in 2014



Sequim Bay State Park Total N and DIN 2009, 2010, 2013, 2014



Blyn Total Nitrogen and DIN 2014



- Decoupling between DIN and TN during *Heterosigma* blooms

Goals of Future Research

- Protect public health through early warning of HAB events
 - Monitor for bloom events
- Protect treaty resources by understanding and ameliorating causes of HABs
 - Collect ancillary oceanographic data (other suggestions)

Photo by Katie Campbell



How do we integrate previous data with ongoing work?

Now that we have most of immediate management questions taken care of we can come full circle back to the big picture.

- Have marine nutrient data: 2009, 2010, 2011, 2012 (some), 2013, 2014
- Some freshwater input data for those years and an intensive study in 2011-2012
- Phytoplankton, temp, salinity data for the State Park 2008-2015 and other sites 2009, 2010, 2012, 2013, 2014



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Questions/ Ideas?